Hospital Topics

Prophylactic Internal Fixation of Secondary Neoplastic Deposits in Long Bones

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Summary

The notes and radiographs of 19 patients who had pathological fractures of long bones due to secondary neoplastic deposits were reviewed. Involvement of over half of the cortex is recommended as an indication for prophylactic internal fixation to prevent the development of a pathological fracture. Eight patients were treated successfully in this way. A notable secondary effect of prophylactic internal fixation was the considerable reduction in pain at the site of the lesion.

Introduction

There are three main groups of patients presenting with secondary neoplastic deposits in long bones: 1, those presenting with a pathological fracture; 2, those presenting with pain; and 3, those where a lesion is found on routine skeletal survey or scintiscan before treatment of a primary tumour.

Operative fixation of pathological fractures in long bones is now well recognized.[1-4] In the cases presenting before the development of a fracture, the pain and the progression of the lesion may be reversed by radiotherapy, which, unless the bone is likely to fracture or the pain persists, is the treatment of choice. There is a group of patients, however, where pain is not relieved by radiotherapy or whose lesion is of such a size that a pathological fracture is imminent. In this group prophylactic internal fixation to prevent the development of a pathological fracture was investigated.

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Material and Method

INDICATION FOR PROPHYLACTIC INTERNAL FIXATION

To determine which secondary deposits preceded pathological fracture, the notes and radiographs of 19 cases of pathological fractures who had prior serial radiographs were reviewed. The radiographs were anteroposterior, lateral, and, where indicated by an offset tumour, obliques. Because of the difficulty of estimating accurately the percentage of bone cortex involved by neoplastic lesions on radiographs, the following four broad groups of involvement were used: less than 25%, 25-50%, 50-75% (fig. 1), and over 75% (fig. 2).

The percentage of cortical involvement, the site of the lesion, the presence of pre-fracture pain, the occurrence of precipitating trauma, and the site of the primary lesion are recorded in table I.

Results

There were no cases of fracture with less than 25% cortical involvement. The relative frequency of a pathological fracture occurring in the other three groups, the proportion of spontaneous to post-traumatic fractures, and the presence of pre-fracture pain are shown in table II.

TABLE II—*Frequency of Pathological Fractures in Three of the Groups Under Study*

Percentage of Cortical Involvement	No. of Fractures	Post-trauma	Spontaneous	Pre-fracture Pain
25-50% ..	1	1	0	0
50-75% ..	6	5	1	3
Over 75% ..	12	4	8	7

TABLE I—*Clinical Data of 19 Cases of Pathological Fracture*

Case	Sex	Percentage Cortical Involvement	Site of lesion	Pre-fracture Pain	Trauma	Primary Neoplasm
1	F.	over 75%	Subtrochanteric	No	No	Breast
2	M.	50-75%	Neck femur	No	Yes	Bronchus
3	F.	over 75%	Neck femur	No	Yes	Breast
4	F.	25-50%	Neck femur	No	Yes	Breast
5	M.	50-75%	Shaft femur	No	Yes	Bronchus
6	F.	over 75%	Neck femur	No	Yes	Breast
7	M.	over 75%	Subtrochanteric	No	No	Lymphosarcoma
8	M.	over 75%	Subtrochanteric	Yes	No	Bronchus
9	F.	over 75%	Neck femur	Yes	No	Breast
10	F.	over 75%	Subtrochanteric	Yes	No	Bronchus
11	F.	50-75%	Neck femur	Yes	No	Breast
12	F.	over 75%	Neck femur	Yes	No	Myxosarcoma
13	M.	over 75%	Midshaft femur	Yes	No	Bronchus
14	F.	over 75%	Subtrochanteric	Yes	No	Bronchus
15	M.	50-75%	Subtrochanteric	Yes	Yes	Myeloma
16	M.	over 75%	Midradius	Yes	Yes	Bronchus
17	F.	50-75%	Midshaft femur	Yes	Yes	Breast
18	F.	50-75%	Midshaft femur	No	Yes	Breast
19	F.	over 75%	Subtrochanteric	No	Yes	Breast

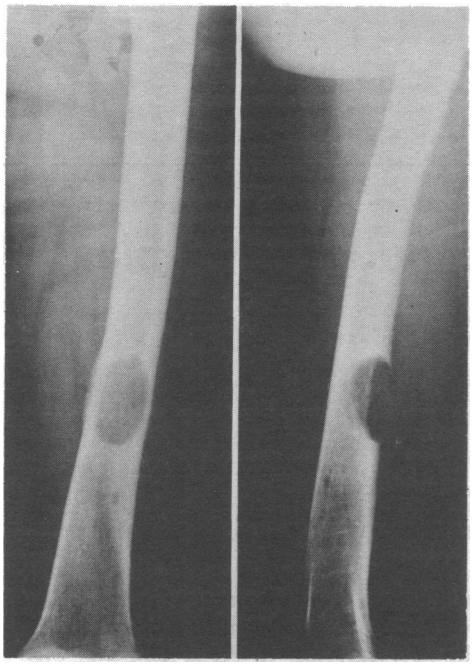

FIG. 1—Anteroposterior (left) and lateral (right) radiographs showing 50-75% cortical involvement.

Minor trauma, consisting of stumbling or tripping, preceded the fracture in six of the seven cases where there was less than 75% cortical involvement, whereas with over 75% cortical involvement eight of the 12 fractures were spontaneous. Of the four post-traumatic fractures cases 3, 6, and 19 followed a stumble, and in case 16 the radius was fractured by the sudden pull of a dog on its lead. Pre-fracture pain was present in 10 cases, occurring in about half of the cases of each group, and therefore cannot be regarded as a sign of impending fracture.

Altogether, 18 of the 19 pathological fractures were preceded by involvement of half or more of the cortex in one or more of the radiographic projections. It was therefore decided that a neoplastic lesion involving half or more of the cortex of a long bone constituted a pre-fracture and was an indication for prophylactic internal fixation.

PROPHYLACTIC INTERNAL FIXATION: PATIENT SERIES

Eight patients involving nine prophylactic internal fixation operations have been admitted to University College Hospital since November 1967 (table III). In only one patient (case 21) was there a complication. A fracture occurred through the neoplastic deposit during the insertion of the Küntscher nail. The postoperative course was satisfactory and the patient was mobilized as usual. The fracture had united five months after operation. After prophylactic internal fixation, none of the lesions in this series has fractured.

Case Reports

CASE 27

A 65-year-old woman had a simple mastectomy in March 1970 followed by radiotherapy for a poorly differentiated carcinoma of the breast (table III). She was seen in the radiotherapy department of University College Hospital on 22 July 1971 complaining of pain in the right thigh which was worse when walking. Radiographs showed a secondary neoplastic deposit in the upper third of the femoral shaft. A bone scan showed increased uptake in the corresponding area. Radiotherapy was started. By 18 August 2,800 rads had been given without relief of pain. A radiograph (fig. 3) showed the secondary tumour to be involving half of the cortex of the femoral shaft. Prophylactic internal fixation was advised. On 19 August a Küntscher nail was inserted via the antegrade approach (fig 4). Postoperatively her pain was relieved and her mobilization was satisfactory. She was discharged on 4 September. When last seen in the follow-up clinic on 22 June 1972 she was painfree and walking well.

CASES 22 AND 23

The patient had a radical mastectomy and postoperative radiotherapy for a poorly differentiated carcinoma of the breast in 1964 (table III). She subsequently had metastases in various parts

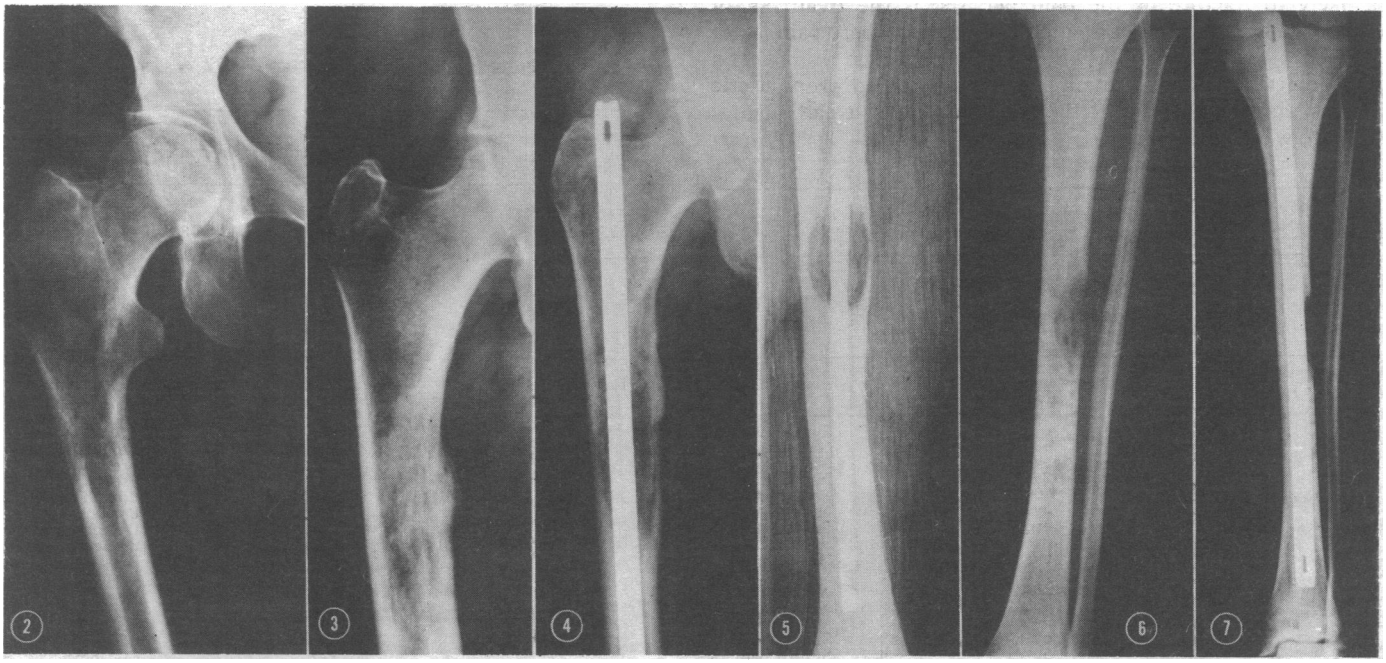

FIG. 2—Radiograph showing over 75% cortical involvement. FIG. 3—Case 27. Radiograph showing 50% cortical involvement of the shaft of the femur. FIG. 4—Case 27. Radiograph showing prophylactic internal fixation with a Küntscher nail. FIG. 5—Case 22. Radiograph showing prophylactic internal fixation of the humerus with a Küntscher nail. FIG. 6—Case 23. Radiograph showing the osteolytic lesion involving 50% of the shaft of the tibia. FIG. 7—Case 23. Radiograph showing prophylactic internal fixation of the tibia with a Küntscher nail.

TABLE III—*Details of Eight Patients involving Nine Operations for Prophylactic Internal Fixation*

Case No.	Sex	Age	Site of Neoplasm		Presentation	Percentage of Cortical Involvement	Preoperative Pain	Operation	Postoperative Pain	Improved Function	Postoperative Survival
			Primary	Secondary							
20 ..	M.	48	Bronchus	Neck R. femur	Pain	over 75%	Moderate	Nail plate	Slight	Yes	6 months
21 ..	F.	59	Breast	Shaft L. femur	Pain	50-75%	Moderate	K. nail	Slight	Yes	14 months
22* ..	F.	50	Breast	Shaft L. humerus	Pain	50-75%	Moderate	K. nail	Slight	Yes	3 months
23* ..	F.	51	Breast	Shaft L. tibia	Pain	50-75%	Severe	K. nail	Slight	Yes	3 months
24 ..	F.	51	Breast	Shaft L. femur	Pain	50-75%	Severe	K. nail	Slight	Yes	11 weeks
25 ..	M.	67	Bronchus	L. gt. trochanter	Pain on walking	50-75%	Severe	Nailplate	Nil	Yes	18 months
26 ..	F.	52	Gall bladder	L. gt. trochanter	Pain on walking	50-75%	Severe	Nailplate	Slight	Yes	10 weeks
27 ..	F.	65	Breast	Shaft of R. femur	Pain on walking	50-75%	Moderate	K. nail	Nil	Yes	10 months†
28 ..	F.	47	Breast	L. subcapital	Pain	50-75%	Severe	Nailplate	Slight	Yes	14 months†

*Cases 22 and 23 are reports on the same patient.
†Alive and well at the time of writing.
K. = Küntscher.

of the axial skeleton which were treated by oophorectomy, anabolic steroids, and local radiotherapy. In January 1969 at the age of 50 years she was again admitted to University College Hospital with pain in both arms, the right more severe than the left. Radiographs showed secondary neoplastic deposits in both humeri and she was treated by radiotherapy. On 2 February she sustained a pathological fracture of the right humerus. Internal fixation of the fracture was indicated along with prophylactic internal fixation of the lesion in the left humerus which involved half of the cortex.

Operation by antegrade insertion of a Küntscher nail on the left (fig. 5) and open reduction and Rush nail on the right was performed on 21 February. Postoperatively she was much more comfortable and had the use of both arms. One week later she developed severe pain in the left leg and could not bear weight. Radiographs showed an osteolytic lesion in the midshaft of the tibia. Her arms were too weak to use crutches and she was bedridden. The tibia was irradiated but after 2,400 rads the leg was still too painful to bear weight. Radiographs (fig. 6) showed 50% cortical involvement by the lesion. Prophylactic internal fixation of the tibia was indicated.

At operation a Küntscher nail was inserted in an antegrade manner (fig. 7). Three weeks postoperatively she was weight bearing. Although she survived for only three months, the prophylactic internal fixation enabled her to be mobile, comfortable, and independent for most of this time.

Discussion

Prophylactic internal fixation of secondary neoplastic deposits in the femur was first mentioned by Griessmann and Schüttemeyer in 1947.[5] Alteman,[6] Bremner and Jelliffe,[2] and Coran *et al.*[3] subsequently reported cases, and in 1970 Parrish and Murray[4] described four cases where the indication for prophylactic internal fixation was increasing pain combined with destruction of at least one half of the cortex. The present study, however, suggests that destruction of half of the cortex alone is sufficient indication for fixation.

All the cases in the present series had over 50% cortical involvement and all presented with pain which in the case of the lower limb lesions was made worse by weight bearing. Although the operations were primarily indicated to avoid the possible development of a pathological fracture, a most rewarding complimentary effect of the operation was the reduction of pain at the site of the lesion in all the cases. This greatly facilitated early postoperative remobilization.

With destruction of half of the cortex of a long bone excessive deformity takes place on weight bearing and causes pain in a similar manner to that during the development of a stress fracture. Internal fixation prevents this stress deformity and this probably accounts for the reduction of pain on weight bearing.

In case 28 (table III) there was in fact radiological evidence of the development of a hairline stress fracture preoperatively. This united satisfactorily.

If a lesion is likely to progress to a pathological fracture, prophylactic internal fixation has the following advantages. (1) The patient avoids the acute distress of the actual fracture. (2) There is no displacement, and hence a possibly difficult reduction is avoided. (3) Internal fixation of a pre-fracture is technically easy; there is little tissue damage and blood loss; Küntscher nailing by the blind antegrade method is especially easy and causes the patient little distress; there is no necessity to open the pre-fracture site or use an image intensifier. (4) Bony continuity is assured. (5) Early postoperative mobilization with no fear of a sudden pathological fracture. (6) Postoperative radiotherapy is easy to administer; there is no danger of a fracture occurring during the initial osteolytic phase which accompanies radiotherapy; radiotherapy is begun on the fourth postoperative day if the wound is satisfactory; delayed healing has not been a problem. (7) Postoperative reduction in pain. (8) Facilitation of nursing care.

A possible objection to prophylactic internal fixation is the effect on local and general tumour spread. Hoare[7] found carcinoma cells in the inferior vena cava after internal fixation of pathological fractures. Campbell[8] did not find any radiological or histological evidence of tumour spread along the track of a Küntscher nail. In the present series there has not been any radiological evidence of local dissemination of tumour tissue. Since these patients already have disseminated disease anyway and prophylactic internal fixation is so beneficial, any possible effect on tumour spread can be ignored.

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